BULLETIN No. 47

THE UNIVERSITY OF NEBRASKA

BULLETIN

OF THE

AGRICULTURAL EXPERIMENT STATION

OF

NEBRASKA

VOL. IX

ARTICLE II.—*Serum Therapy in Hog Cholera.* By A. T. PETERS, D. V. M.

DISTRIBUTED FEBRUARY 1, 1897

LINCOLN, NEBRASKA
U. S. A.

Serum Therapy in Hog Cholera. By A. T. Peters, D. V. M.

It is known that the preparation of antitoxins* is based upon the discoveries of Dr. Behring, who proved "that the blood serum † of animals, rendered artificially immune against certain infectious diseases, injected into another animal will protect it against such disease or even cure it after infection." This treatment is known as "Serum Therapy." The weak point of this new theory is our lack of understanding of the nature of immunity, inasmuch as there are several theories, notably those of Pasteur, Metschnikoff, Buchner, Behring, Roux, and others. Each opposes the other; none fully explains the phenomena. We know, however, by empirical observation that certain animals or classes of animals are protected by nature; that is, they are "naturally immune" against particular diseases which are fatal to others. We also know that a previous sickness in certain diseases, such as scarlet fever, small-pox and yellow fever in man, influenza in horses, and many other diseases, usually produces an "acquired immunity," at least for a reasonable length of time, against another attack of the same disease. Moreover we know that we can render animals "artificially immune" against some infectious diseases by protective inoculation. Lately we seem to have reached the point when "curative immunity" can be produced in time to counteract the infection and ward off the fatal toxic effects of certain germ diseases by the application of antitoxins.‡

Serum therapy (treatment) is being used in various diseases. Dr. Schafer, after considerable research, discusses this subject with the following general results:

1. Tuberculosis.—Treated with serum obtained from refractory animals by Richet and Hericourt without definite results up to the present time.

*Antitoxin. A substance present or generated in the body, which neutralizes the action of poisons introduced or generated there.

†Serum. The watery part of animal fluids, as of blood and milk. The serum of blood is the liquid which separates from the blood when coagulated at rest.

‡Journal of Comparative Medicine and Vet. Archives, Vol. XVII, No. 1.

2. Rabies.—*Immunization by vaccination gives better results than serum treatment.*

3. Pneumonia.—Serum from immunized rabbits is difficult to obtain, consequently this treatment has not been used to any great extent. The subject is promising enough to deserve further investigation.

4. Enteric Fever.—Good results have not been obtained in practice, though laboratory experiments are very promising. This may be *due to mixed infections or to the length of time between penetration* of the poison, and the treatment.

5. Typhus.—Legrain, during an epidemic in Algeria, used the serum *from patients who had suffered from this disease, with good results.*

6. Cholera.—Cholera in man is different from that in animals. Nothing definite is known as yet, but Behring announces that he has a curative serum. His researches are not yet published.

7. Syphilis.—Sometimes good results have been effected with serum from dogs and lambs.

8. Streptococcus Infection.—The serum from animals immunized by vaccination has been employed with good effect in angina erysipelas and puerperal fever.

9. Cancer.—There are no satisfactory results thus far.

10. Tetanus.—This affection is very hard to cure in animals, and there have been no conclusive results obtained in man. The serum, however, acts as a prophylactic agent against tetanus.

11. *Diphtheria.—Here it is that serum treatment has scored its most* remarkable triumph. The few accidents that have occurred may be overlooked when we consider the wonderful success that has been attained.

12. Serum treatment has also proved successful in snake bites.*

13. Swine Erysipelas.—Dr. Lorenz, of Darmstadt, Germany, has introduced a method of protecting pigs against swine erysipelas by subcutaneous injections of blood serum from animals previously rendered immune against this disease. In the first experiments he obtained the serum from previously protected guinea pigs and rabbits, but it will very readily be seen that these animals were too small and did not yield enough blood to make it practical, and therefore he purchased pigs nearly ready for slaughter, and these he inoculated with protect*ive material previously obtained from the blood of rabbits. In nearly*

* Medical Record, Vol. 49, No. 8.

all cases the animals exhibited no reaction and continued to thrive under the treatment. When they became protected he killed the animals, and their blood serum was used to protect other pigs. The blood serum used was injected subcutaneously behind the ear or between the thighs. It is asserted that this method has already been used on a large scale, which is shown by the table which accompanies Dr. Lorenz's article, and that it is devoid of danger, and successful in conferring protection.

WORK AT STATION.

The production of antitoxins is preceded by the preparation of their toxins in the bacteriological laboratory. For the cultivation of the hog cholera bacilli a liquid cultivating medium is prepared in the following manner:

One kilogramme of lean beef is boiled in four litres of distilled water for five hours. It is then strained, and neutralized with a caustic soda solution. Then forty grams of common salt are added (ten grams per litre). This infusion is sterilized by discontinuous steaming in stock flasks of convenient size, and incubated thoroughly before it is used as a cultivating medium. These flasks are then charged with blood from the heart of an animal, which had a mild attack of hog cholera. The inoculating rod is made of a piece of platinum wire fastened to the end of a glass rod. This rod is passed through a flame until the wire at its end becomes red hot. It is then allowed to cool a moment. After dipping the end of the wire into the blood of the heart the cap is removed from the flask containing the culture medium and the charged rod is quickly introduced and withdrawn. This is repeated three times, removing and replacing the cap each time.

The flask is then placed in the incubator for from two to four days. Soon the germs begin to multiply and the previously clean culture medium becomes cloudy and milky. At the end of three or four days the culture is ready for use. The hog cholera cultures used at the laboratory to make horses immune were of the first generation. The horses selected at the station for this purpose are healthy, strong, and large animals, of good disposition. The circulation, respiration, and temperature must be normal, and they must be free from any disease, and must have undergone the mallein test for glanders.

For inoculation, two sterilized hypodermic syringes are used, one

holding ten cubic centimetres and the other holding about sixty cubic centimetres. The first for small and the latter for large doses.

Syringes with asbestos plungers are preferable, because they can be sterilized by heat without altering or destroying their usefulness. We select the thorax or flanks as the best places for injections: The proximity to the extremities being avoided on account of subsequent œdematous swellings. A piece of skin the size of a dollar is shaved, washed, and disinfected with a solution of bichloride of mercury. The culture is then drawn into a sterilized syringe of the capacity of ten to fifty cubic centimetres, and slowly injected subcutaneously. We commence with a small injection of five cubic centimetres of a culture of the first generation and gradually increase during several weeks to several months to two hundred cubic centimetres. The effect of the hog cholera culture upon the system of the horse is mainly a rise in temperature of one and one-half to three degrees, a quickened circulation, and accelerated respiration, but not in a very pronounced type. At the point of inoculation in nearly all cases a very hard and intensely sensitive swelling is produced, varying in size. When not absorbed it terminates in either abscesses, new connective tissues, or slough. These conditions are treated in the usual way.

When a horse is able to take one hundred or two hundred cubic centimetres of a virulent, peptonized hog cholera culture without producing any marked abnormal symptoms it has acquired considerable immunity. A small amount of blood, about one-half a litre, is then drawn and tested to determine the amount of antitoxin it contains. If up to the standard about six litres of blood are drawn from a horse of average size, the injection of culture is continued for three or four weeks, and then if conditions are favorable the bleeding process is repeated, and the strength determined as before.

For one week prior to the bleeding, the horse must be free from all toxic symptoms, during which time it receives no more injections. The horses so bled appear to suffer no inconvenience from the same, but on the contrary are more lively and have an increased appetite. The amount of hog cholora culture an animal receives is no indication of the strength of the antitoxin obtained. Therefore it is necessary that the serum from each and every drawing should be tested. When the blood is drawn it passes into two sterilized flasks and is kept in the refrigerator in the laboratory for three or four days to allow the clot

to press out the serum. The serum is then siphoned off into a large bottle and filtered through a large Chamberland filter. This filtered serum is then put up in bottles holding one hundred cubic centimetres each, which are set in a dark, cool place, ready for use. The filter used is described by Dr. Campbell in the Johns Hopkins Hospital Bulletin No. 51.

Experiments have shown that it takes from eight to ten cubic centimetres or more of blood serum to make a hog immune. The main facts connected with immunity have been known from time immemorial. The horse does not contract the bovine disease called contagious pleuro-pneumonia. The ox has a like freedom from glanders. They are examples of what is termed inherited or natural immunity. Before endeavoring to discover what happens when the germs of an infectious disease find their way into the body of an animal that has *acquired immunity by a previous attack, it is well to have clear* ideas regarding the way in which the germs of infectious disease produce their deleterious effects. The pathogenic bacteria are vegetable parasites, and like many of the more highly organized members of the same kingdom they elaborate substances that are poisonous to the animal body.* As a familiar instance Cadeac cites the experiment of putting yeast in a solution of sugar, which mixture will produce carbonic acid and alcohol. After a certain time the fermentation will stop. If we add sugar to the liquid, yeast will recommence growing, but the fermentation will soon again stop and will not begin afresh even if we add more sugar. If, on the contrary, we add water, the fermentation will commence again, and will also do so, if, by heating, we drive off the alcohol which has been formed. In the first case the effect of the water was not to add to the materials necessary for the nutrition of the ferment, but to dilute the matters formed by the yeast, of which alcohol was the principle one. In the second, the heat expelled the alcohol or considerably diminished it, and the fermentation commenced anew. Here the alcohol has poisonous or paralyzing effects on the yeast which produces it. The theory may explain the fact that certain diseases, like contagious pleuro-pneumonia and pink-eye, run a definite course, at the end of which, if the animal has survived the severity of the symptoms, the disease will disappear. In this class of diseases the acquired immunity will naturally be comparatively short-lived.

* Journal of Comparative Pathology and Therapeutics, Vol. VII, part 2.

In affording an explanation for the action of the system in resisting the attack of disease germs, pathologists as a rule take one of two sides, namely, of those who hold the theory that protection is obtained by serum of the blood, or that of those who, with Metschnikoff, *award the credit to the leucocytes and cells of the part.* Perhaps the safer plan would be to regard both theories as partly correct. Nuttall, Buschner, and others have shown that serum of the blood without the presence of leucocytes has a well marked germicidal action, which, according to Von Fodor, is in accordance with the immunity of the particular animal. Now Von Fodor has shown that the germicidal power of the serum decreases with the temperature and that it is strengthened by the addition of a drug, which, like carbonate of potash or carbonate of soda, increases the alkali of the blood. We know that in inflammation the leucocytes and the cells of the injured part absorb and digest dead and effete matter.

Now acquired immunity is never absolute. Thus, though one attack of small-pox or one of strangles almost always confers an immunity from a second attack in, respectively, man or horse, exceptions are now and then met with. This immunity lasts a long time in some diseases, only a short period in others, and may have a negative influence. In malarial fever, for instance, one attack increases the susceptibility for another attack. In those diseases in which one attack has a well marked power of conferring subsequent immunity, protection, according to Metschnikoff, is acquired by the previous training and devouring of microbes which the leucocytes have undergone. If we inoculate the virus of anthrax, for example, under the skin of an ordinary rabbit, and of a rabbit which has been protected by vaccination, we may observe the following results at the respective seats of inoculation: In the ordinary rabbit the microbes multiply rapidly, the swollen part is full of watery fluid and is poor in cells. Little by little the swelling extends, the neighboring ganglions enlarge, and the infection becomes generalized. In the protected rabbit, on the other hand, the bacilli multiply at first, but soon the leucocytes arrive in such great numbers that the microbes are taken and killed. The fluid in the swelling instead of being clear becomes thick. Cells are abundant in it and the bacilli disappear. The disease does not extend, and it becomes cured.*

*Veterinary Journal, Vol. XLII, No. 249.

EXPERIMENTS.

The experiments that have been conducted in the laboratory were as follows:

Hog No. 1 was a Poland China sow, weighing about 100 pounds. She was in good health at the time and was inoculated with one drop of blood taken from the heart of a small pig that had died at the laboratory with hog cholera. She was inoculated on August 6, 1896. The sow received at the same time ten cubic centimetres of blood serum from horse No. 1. August 7 the animal was in good condition and showed no signs of any disease. August 9, at the seat of the inoculation, could be seen the formation of a small abscess, which was undoubtedly caused by the injection of the blood, which had a number of putrefying germs in it in connection with the hog cholera bacilli. On August 11 the abscess broke and discharged pus, but the animal showed no signs of disturbance. August 15 the abscess had healed and the animal was to all appearances healthy. On August 20 the animal was sent to Mr. C. A. Morrill, Stromsburg, so that he might put the animal in an infected herd and have the owners feed it dead material. The animal remained at Mr. Morrill's farm for about a week, for at that time there was no suitable outbreak where the animal could be placed. After eight or ten days Mr. Morrill placed the animal in a herd where the owner had lost twenty head and still had fifteen sick. These remaining fifteen died, but the inoculated hog remained there two weeks after the last one had died. Then Mr. Morrill took the animal back to his own farm in order to place it in another infected herd, but during this time the animal sickened and died. We were notified too late, and did not receive any blood, nor could we make any post mortem, but Mr. Morrill is certain that the animal died of cholera, as he stated that the animal showed all the symptoms of cholera.

Hog No. 2.—This animal was inoculated August 6, 1896, at 10 A. M. and received blood from the same animal as did hog number 1, but hog number 2 did not receive any serum, and was tagged "unprotected." On August 6, at 6 P. M., the animal was very dull. It would lie down most of the time and did not partake of the noon ration. The animal could not be aroused in the evening and did not seem inclined to take any food. August 7, at 8 A. M., the animal was a little better. It had partaken of half of the morning ration. On August

8 the animal began coughing and showed the characteristic red spots on the abdomen and flanks. August 9, at the seat of inoculation, could be seen the formation of a large abscess. August 10, 1896, the animal lay on the abdomen most of the time, partook of little or no food, and coughed very frequently. August 11 the animal seemed falling off in flesh, having taken up no food. August 12 condition not changed. August 13 about the same. August 15 animal found dead; must have died during the night. On post mortem the characteristic lesions of hog cholera were found.

Hog No. 3 was inoculated August 18, 1896. It was a shoat weighing about 100 pounds. It was inoculated with the blood sent in from Broken Bow. It received with this one drop of blood, ten cubic centimetres of serum. On August 19 the animal seemed in good health. On August 20 the same. September 15 the animal seemed to cough a little. On September 16 the condition was no better. On *September 17 the animal was found dead in the stall.* On September 18 post mortem revealed that the subcutaneous skin all along the abdomen was perfectly yellow. The lungs revealed no congestion nor any deposits of any kind. The kidneys were enlarged, and the liver was very much enlarged and hard. On opening the bile duct we found that it was obstructed with worms and that it was very much enlarged and distended. Judging from the post mortem appearances, the hog *did not die from cholera. Microscopical examination also revealed no* bacilli.

Hog No. 4.—This hog received August 18, 1896, one drop of blood sent in from Broken Bow, and ten cubic centimetres of serum. August 19 the animal seemed in good health. August 20 the same. October 17 the animal was sent to Mr. John Reese, of Broken Bow, to be placed in a herd that was infected with hog cholera. On October 20 Mr. Reese placed it in a herd owned by Mr. Geo. Carr, which were dying with cholera. On December 14 this hog is still alive and is doing well.

Hog No. 5.—August 18, 1896, the animal was inoculated with one cubic centimetre of blood sent in from Broken Bow, and tagged "unprotected." August 19 the animal would not partake of anything. August 20 the animal was very sick and commenced to cough and ate but very little. August 21 condition was no better. The animal lay down most of the time. August 22 condition about the same; 23, no change;

24, the animal was found dead. Post mortem revealed that the intestines and lungs were very much inflamed. Numerous swine plague bacilli were found in the lungs, while in the spleen the hog cholera bacilli were found abundant.

Hog No. 6.—This animal weighed about 100 pounds, was inoculated with one cubic centimetre of blood August 18. August 19 the animal was very dull. August 20 the animal took very little nourishment. August 21 the condition was about the same. August 22 the animal began to cough quite freely. August 24 the animal seemed but little better. There was a noticeable wasting away of flesh. August 27 the animal's condition about the same. August 28 the animal was found dead. Post mortem examination revealed the characteristic appearance of hog cholera.

Hog No. 7 was inoculated September 15 with ten cubic centimetres of serum and one cubic centimetre of a virulent culture of hog cholera four days old. On September 16 the animal seemed in good health. On September 18 no abscesses had formed as yet. From all appearances the animal enjoyed good health. At this date, December 14, the animal is still alive and is ready to be sent into an infected herd.

Hog No. 8 was treated with ten cubic centimetres of serum and one cubic centimetre of culture. At this date, December 14, it is ready to be sent into an infected herd.

From the experiments it will be seen that the unprotected animals have died, and there are only two cases where a protected animal died from the disease; in fact, I might say one, if I did not count the one which had the yellow appearance and the obstructed bile duct. The one that was sent to Mr. Morrill led us to presume the blood serum had only a limited power of immunity, or that the animal did not receive a sufficiently large dose of serum. This is very distinctly seen in the herds of Messrs. Jos. and Geo. Hedge. Their herd was inoculated August 6, 1896, when the disease was raging all around them. Their herd did not take the disease until eight weeks later, when the herd were infected, and all but seven were lost. The other herd was Mr. Z. S. Branson's. His herd of thirty-six head was inoculated August 6, 1896. The disease was on the adjacent farm, but he did not report a loss until eight weeks later, when he lost all but thirteen. Mr. D. Hedge had his herd of forty-two head inoculated. Fourteen of these were small pigs, twenty-four shoats, and eight sows. He had the disease

on his place, three having died before treatment. At the time of treatment it seemed to check the disease for about five weeks, when, after that time, he lost all but six.

From these investigations we judge that the serum injected alone has only a limited power of immunity. We have, therefore, experimented with the antitoxic serum in connection with a virulent hog cholera culture, injecting approximately per body weight about ten cubic centimetres of antitoxic serum to one cubic centimetre of virulent hog cholera culture. We have lately treated twelve head for the Experiment Station in this manner, with good results thus far. The animals manifest no disturbance from the inoculation. Up to the present date we have by this method not produced the disease, and hope to lengthen the duration of immunity through it.

The following is a list of the field experiments:

	Treated.	Sick.	Saved.
Mr. Sullivan	12	2	10
Mr. Brown	64	18	53
Mr. Grow	15	11	7
Mr. Wolfe	103	82	30
Mr. Stutt	39	6	9
Mr. Neu	18	7	17
Mr. Cooley	25	20	8
Mr. D. Hedge	42	4	11
Mr. John Jeffery	57	10	14
Mr. William Bubb	7	7	3
Mr. Z. S. Branson	36	3	13
Mr. Isaac Pollard	17	17	15
Mr. Fred Pollard	1	1	...
Mr. J. E. Mussetter	8	8	3
Mr. N. Katz	57	5	9
Mr. Morrill	12	12	8
Mr. J. G. Mickey	66	14	55
Mr. Wm. Carpenter	17	8	15
Mr. E. J. Briggs	18	...	18
Mr. Thomas Black	21	21	21
Mr. Robt. Vansteenberg	11	4	10
Mr. H. C. Oswald	47	6	40

	Treated.	Sick.	Saved.
Mr. Philip Unitt	98	50	50
Dr. Fred Evans	48	Many	46
Mr. D. S. Harris	50	...	...
Mr. V. W. Jeffrey	23	...	7
Messrs. Jos. and Geo. Hedge	43	7	7
Mr. O. M. Easterday	21	...	6
Mr. E. A. Perrin	28	1	11
Mr. Marshall Stein	27	...	27
Mr. Walker	15	15	6
Mr. Jno. Reese	118	...	118
State Farm	12	...	12
	1,176	339	659

From the above table it will be seen that out of 1,176 animals treated a little more than 56 per cent were saved. The exact number of animals that showed signs of sickness cannot be given since in a few instances this was not reported. In those cases which showed no signs of sickness at the time of treatment, cholera was raging in the neighborhood, so that the animals had been exposed to the disease.

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CIRCULAR No. 3.
(JUNE, 1903.)

HOG CHOLERA.

BY ARCHIBALD R. WARD,
Veterinarian and Bacteriologist.

Symptoms.—It is quite impossible to mention a series of symptoms to be relied upon always in recognizing the disease. The name is misleading, in that the bowels are not necessarily loose, but a diarrhea is most common. There may be constipation. Such animals are spiritless and generally do not stir about. In advanced cases there is a staggering gait. There is frequently trouble with the eyes, causing a discharge, and there may be a reddening of the skin on various parts of the body. Some die of an acute type of the disease within a few days after coming down, while others will suffer for weeks from a chronic (mild) form.

Post-Mortem Appearances.—The most constant of the diseased alterations of the carcass is the presence of little red spots sprinkled over the various organs. They are found on the kidneys, on the intestines, or stomach, heart, diaphragm, lungs, or the lining of the lung or intestinal cavities and elsewhere. Little glands colored red by blood are found scattered along the membrane that attaches the intestines to the back. The spleen is enlarged and darkened in color. In cases of long standing there may be found ulcers on the inside of the intestines. They are circular in shape, project slightly, and are grayish-yellow or black in color. These ulcers are most apt to be found in the large intestine. If ulcers are found, it is usually safe to conclude that the disease is hog cholera, but the absence of them is not significant. The lungs are not commonly seriously diseased, but may be solidified in spots.

How Hog Cholera Is Spread.—The disease is caused by germs which are responsible for its existence and spread. The germs are present in the intestinal discharge of the sick, and consequently the disease spreads rapidly when introduced among pigs. Hog cholera can be prevented

by paying strict attention to the various means by which it is spread from the sick to the healthy. Chief among these are:

1. Purchase of hogs from diseased herds. The animals may be actually suffering from a mild attack of cholera or they may convey the germs upon the filth adhering to their bodies.

2. Railroad shipping-pens, cars, and other inclosures may harbor infecting material dropped by diseased hogs in transit.

3. There is an overwhelming amount of evidence showing that the disease may be carried by streams of water. A very fruitful means of spreading the disease is to throw a dead hog in a stream or to allow diseased hogs to have access to a stream.

4. The germs may be carried from the diseased to the healthy by the filth adhering to the shoes of a man, the feet of a dog, or farm utensils. When hog cholera is prevalent in a community, owners of healthy hogs should not go among sick hogs, because of the danger of carrying the infection home.

5. Buzzards and other carrion birds and animals may spread the disease.

A few pigs only are affected when the disease first breaks out, and if they are noticed and prompt action taken the spread may be checked. The healthy ones should be removed from the pens or field where the disease has appeared, and be given a supply of well water. Animals kept in small inclosures are less apt to contract the disease than those running on large areas of land, as they are usually allowed to do in California. Wallowing-holes of mud are conducive to the spread of the disease. The dead should be burned or buried in quicklime.

Buildings, feeding-troughs, and land contaminated by sick pigs will harbor the disease for many months. After an outbreak the disinfection of buildings and feeding-troughs is necessary before introducing healthy hogs. The following is a good cheap disinfectant:

Crude carbolic acid	½ gallon.
Crude sulfuric acid	½ gallon.

"These two substances should be mixed in tubs or glass vessels. The sulfuric acid is very slowly added to the carbolic acid. During the mixing a large amount of heat is developed. The disinfecting power is heightened if the amount of heat is kept down by placing the tub or demijohn containing the carbolic acid in cold water, while the sulfuric acid is being added. The resulting mixture is added to water in the ratio of 1 to 20. One gallon of mixed acid will thus furnish 20 gallons of a strong disinfecting solution, having a slightly milky appearance. The mixture should be applied to the walls and floors of the pens, saturating them with it."

Small yards may be disinfected with slaked lime. Extensive ranges are preferably not used for a year, although some authorities place the

period for the eradication of infection by *natural climatic agencies at* six months.

Treatment.—There is no medicinal treatment that can be relied upon to cure every case of hog cholera. In numerous cases medicines have been administered and the animals have recovered, but such an occurrence does not prove that the medicine induced the favorable change. It is a matter of common observation that the violence of the disease may abate very abruptly without apparent cause.

Much can be done to ward off the disease and perhaps to cure mild cases by the use of the following medicine recommended by Dr. D. E. Salmon, Chief of the Bureau of Animal Industry of the United States Department of Agriculture:

	Pounds.
Wood charcoal	1
Sulfur	1
Sodium chlorid	2
Sodium bicarbonate	2
Sodium hyposulfite	2
Sodium sulfate	1
Antimony sulfid (black antimony)	1

"These ingredients should be completely pulverized and thoroughly mixed. In case there is a diarrhea the sulfate of sodium may be omitted.

"The dose of this mixture is a large tablespoonful for each 200 pounds weight of hogs to be treated, and it should be given only once a day. When hogs are affected with these diseases they should not be fed on corn alone, but they should have at least once a day soft feed, made by mixing bran and middlings, or middlings and corn meal, or ground oats and corn, or crushed wheat with hot water, and then stirring into this the proper quantity of the medicine. Hogs are fond of this mixture, it *increases their appetite, and when they once taste of food with which it* has been mixed they will eat it though nothing else will tempt them.

"Animals that are very sick and that will not come to the feed should be drenched with the medicine shaken up with water. Great care should be exercised in drenching hogs or they will be suffocated. Do not turn the hog on its back to drench it, but pull the cheek away from the teeth so as to form a pouch, into which the medicine may be slowly poured. It will flow from the cheek into the mouth, and when the hog finds out what it is, it will stop squealing and swallow. In our experiments hogs which were so sick that they would eat nothing have commenced to eat very soon after getting a dose of the remedy, and have steadily improved until they appeared perfectly well.

"This medicine may also be used as a preventive of these diseases, and for this purpose should be put in the feed of the whole herd. Care should of course be observed to see that each animal receives its proper

share. In cases where it has been given a fair trial, it has apparently cured most of the animals which were sick and has stopped the progress of the disease in the herds. It also appears to be an excellent appetizer and stimulant of the processes of digestion and assimilation, and when given to unthrifty hogs it increases the appetite, causes them to take on flesh and assume a thrifty appearance."

The administration of the medicine is useless unless the patients are kept under comfortable conditions with careful feeding.

There has been much careful experimental work done in an effort to produce a serum for injecting under the skin of hogs, to cure the cholera or to immunize the system against it. Some experiments have yielded satisfactory results on a small scale, but this line of treatment has not progressed far enough to be of practical use as yet.

Quarantine Regulations for Hog Cholera.—Prevention of the disease by strict quarantine must ever be relied upon to check the enormous losses from hog cholera. Individuals who have carefully studied the disease can accomplish much by voluntarily observing the precautions necessary to prevent its spread. But to effectually restrict hog cholera, regulations with the force of law must exist, as well as a corps of men to enforce them. California is sadly lacking in these requisites, and until they are supplied the swine industry must continue to suffer appalling losses annually.

As an example of the kind of measures necessary for the control of hog cholera there is appended a copy of a circular giving directions for quarantining infected animals:

MINNESOTA STATE BOARD OF HEALTH.

CIRCULAR OF INFORMATION FOR LOCAL HEALTH OFFICERS.

FOR QUARANTINING HOGS SUFFERING FROM ANY INFECTIOUS DISEASE.

The proper quarantine of hogs imposes no hardship upon either the owner or the hogs themselves. The chief purpose of the Board of Health in quarantining any suspicious disease among hogs is to protect the financial interests of the hog-raisers. Valuable time is often lost before quarantine is established. This permits serious spread of the disease to take place, and makes its control much more difficult.

The disease now prevailing in different portions of the State varies in symptoms in different localities and in different herds. It may be set down as a rule, however, when any infectious (catching) disease appears among swine that it is hog cholera, modified more or less in symptoms by well-known complications.

When hogs begin to sicken and die during the prevalence of hog cholera the disease should be reported to the local health officer or chairman of the town board, and quarantine should be established at once. It is a simple matter to release quarantine, and should it be proven that the disease is not hog cholera, no harm has been done by such quarantine.

All health officers and acting health officers are therefore instructed to see that suspicious outbreaks of disease among hogs are properly quarantined.

The health officer should explain to the owner or keeper the nature and conditions of quarantine, and see that the conditions are rigidly enforced until quarantine is released.

Hog cholera is often spread by water in small streams and lakes, and for this reason hogs must not be buried near any such lake or watercourse.

Poultry should not be allowed access to yards or pens where hogs are confined during the hog cholera season, and pigeons and crows should be shot or otherwise frightened away, because of danger that they may spread the disease.

The health officer or inspector should always wear overalls and overshoes or rubbers when going among diseased hogs. These overalls and overshoes or rubbers should always be kept a safe distance from healthy hogs and from other agents which might convey the disease.

Quarantine cards must not be removed until six months after the last hog has died or recovered, and the premises disinfected in a way satisfactory to the local board of health.

Farmers should be urged to dispose of marketable hogs for slaughter as soon as suspected hog cholera appears in the neighborhood.

Racks and wagon boxes used for hauling such hogs must be tight and so constructed at the bottom as to prevent the scattering of manure and litter along the highway.

Racks and wagon boxes, which have been used for transporting such hogs, must be thoroughly disinfected as soon as the work is finished. All parts of the wagon that have come in contact with the hogs or litter must be thoroughly disinfected. Five per cent solution of crude carbolic acid in water is cheap and effective.

Neighbors on whose farms the disease has not yet appeared should never be allowed to help haul the hogs from infected farms, as there is great danger that the disease will be spread from farm to farm by such action.

The following placards are required to be posted in a conspicuous place by owners of swine in a community where the disease exists:

MINNESOTA STATE BOARD OF HEALTH.

HOG CHOLERA!

EXISTS ON THESE PREMISES.

All persons, excepting the owner, duly authorized attendants, or medical advisers, are forbidden to enter any inclosures where hogs are kept on these premises, until this card has been removed by permission from the State or local Board of Health.

Hogs must not be removed from these premises after date of this card, until six months after the last case of suspicious swine disease has died or recovered, except in the following cases: 1st, by permission in writing given by the State Board of Health; and 2d, dressed carcasses of healthy hogs killed under inspection of the State or local Board of Health.

No hogs, excepting those hereby quarantined and their offspring, shall be allowed upon these premises until six months after the last hog has died or recovered. During this period of six months no other domestic animal shall be permitted in these pens for any reason whatever.

Parties living on this place must not go near pens or yards where hogs are kept on other farms.

Keepers of these hogs will be held responsible for the unauthorized removal of this notice, and for allowing any swine hereby quarantined to escape from these pens or yards and run at large.

By order of

——— ———, Health Officer.

Dated ——— ———, 19—.

CHAPTER 233, LAWS OF 1897 (Minnesota).—Section 9. Any person violating any provision of this Act or any rule or regulation made by the State Board of Health, or by any local Board of Health, or any order made by any such board under the authority hereof, shall be guilty of a misdemeanor and be punished by a fine of not less than twenty-five (25) or more than one hundred (100) dollars, or by imprisonment for not less than thirty (30) or more than ninety (90) days.

[For Use by Owners of Hogs.]

NOTICE.

All unauthorized persons are forbidden, under penalty of the law, to approach on these premises nearer than 50 feet to any pens or yards where hogs are confined.

———— ————.

Signature of owner.

CHAPTER 233, LAWS OF 1897 (Minnesota).—Section 11. Whenever during the prevalence in the State of any contagious or infectious disease among domestic animals, the owner shall post on his premises a notice forbidding all persons not authorized by State or local Boards of Health to enter any building or inclosure on said premises, without permission from said owner, it shall be a misdemeanor to enter upon such premises, punishable by a fine of not less than twenty-five dollars ($25) nor more than one hundred dollars ($100), or by imprisonment for not less than thirty (30) days nor more than ninety (90) days.

Swine Plague.—This disease is as common as hog cholera, and most outbreaks of the cholera are complicated by it. The symptoms do not greatly differ from those of hog cholera, except that it is more commonly a disease of the lungs, and consequently there is apt to be coughing. The treatment and methods of sanitation do not differ markedly from those laid down for hog cholera. In consequence, the definite recognition of the disease is not of great practical importance to the owner of the animal.

Soap Powder Poisonous to Hogs.—Some deaths among hogs in New York State were found by Dr. V. A. Moore, of the New York State Veterinary College, to be caused by one of the soap powders in common use. Upon investigation it was found that the soap powder was used in washing dishes in a kitchen, and that the dishwater found its way to the hogs in swill. Carefully conducted experiments later showed that pigs could be killed by feeding them amounts of soap powder smaller than commonly used in kitchens. In cases of deaths among swine it is, therefore, desirable to ascertain that the food is wholesome.

SACRAMENTO:
W. W. SHANNON, - - SUPT. STATE PRINTING.
1903.